

IN THE CLAIMS:

Please cancel Claims 47-53 and 55 without prejudice or disclaimer of subject matter.

Please amend Claims 1-3, 5, 7, 9, 10, 12, 13, 37-39, 42, 46 and 54 and add Claims 56-59 as follows. Note that all the claims currently pending in this application, including those not presently amended, have been reproduced below for the Examiner's convenience.

1. (Currently Amended) A projection optical system, comprising:

at least one lens;

~~at least one concave mirror;~~

~~at least one diffractive optical element;~~

a first imaging optical system, ~~having said~~ consisting of at least one first lens and ~~said~~ at least one concave mirror, for ~~imaging~~ forming an intermediate image of an object;

a second imaging optical system, ~~having said~~ consisting of at least one second lens and ~~said~~ at least one diffractive optical element, for projecting the intermediate image onto an image plane; and

a field optical system disposed between said first and second imaging optical systems,

wherein said projection optical system is arranged to image, upon the image plane, only abaxial light from the object.

2. (Currently Amended) A projection optical system ~~according to~~

~~Claim 1, comprising:~~

a first imaging optical system having at least one first lens and at least one

concave mirror, for forming an intermediate image of an object;

a second imaging optical system having at least one second lens and at least one diffractive optical element, for projecting the intermediate image onto an image plane;

and

a field optical system disposed between said first and second imaging optical systems,

wherein ~~said at least one lens, said at least one concave mirror and said at least one diffractive optical element have a positive refractive power, respectively, and wherein said projection optical system does not include a lens having a negative refractive power, a mirror having a negative refractive power, a mirror having a negative refractive power or a diffractive optical element having a negative refractive power~~ the or each lens, the or each mirror and the or each diffractive optical element of said projection optical system all have a positive power.

3. (Currently Amended) A projection optical system according to

Claim 1, wherein said at least one first lens, said at least one concave mirror, said at least one second lens, and said at least one diffractive optical element ~~include a lens, a concave mirror and a diffractive optical element of~~ have a positive [refractive] power.

D3

5. (Currently Amended) A projection optical system according to Claim 1, wherein said first and second imaging optical systems are disposed along a common straight optical axis, and wherein abaxial light from the object as reflected and collected by said concave mirror ~~is caused by said mirror to pass~~ passes through an outside portion of an effective diameter of said concave mirror, toward the image plane side.

D4

7. (Currently Amended) A projection optical system according to Claim 5, wherein said first imaging optical system includes at least a lens having a positive ~~refractive~~ power, a reflection mirror and said concave mirror, which are disposed in the order mentioned above, from the object side.

8. (Original) A projection optical system according to Claim 7, further comprising a lens group disposed between said reflection mirror and said concave mirror.

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9. (Currently Amended) A projection optical system according to Claim 8, wherein said lens group has a negative refractive power and is disposed between said concave mirror and a lens, in said first imaging optical system, having a positive refractive power.

10. (Currently Amended) A projection optical system ~~according to Claim 1, further comprising:~~

a first imaging optical system consisting of at least one first lens and at least one concave mirror, for forming an intermediate image of an object;

a second imaging optical system consisting of at least one second lens and  
said at least one diffractive optical element, for projecting the intermediate image onto an  
image plane;

a field optical system disposed between said first and second imaging  
optical systems; and

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a reflection surface disposed adjacent to an intermediate image formed by  
said first imaging optical system, and

wherein abaxial light from the object as reflected and collected by said  
concave mirror is deflected by said reflection surface toward said second imaging optical  
system.

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11. (Previously Amended) A projection optical system according to  
Claim 1, wherein at least one of said at least one diffractive optical element of said  
projection optical system satisfies a relation:

$$3 < MP/\lambda < 50$$

where MP is a minimum pitch (micron) of the diffractive optical element, and  $\lambda$  is the  
exposure wavelength (micron).

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12. (Currently Amended) A projection optical system according to  
Claim 1, comprising:

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a first imaging optical system having at least one first lens and at least one  
concave mirror, for forming an intermediate image of an object;

a second imaging optical having at least one second lens and at least one diffractive optical element, for projecting the intermediate image onto an image plane; and  
a field optical system disposed between said first and second imaging optical systems,

wherein at least one of said at least one diffractive optical element of said projection optical system satisfies a relation:

①  $|L_d/L_{g2}| < 0.2$

where  $L_d$  is the distance between an aperture stop of said second imaging optical system and said diffractive optical element, and  $L_{g2}$  is the distance from a paraxial image plane position of an intermediate image formed by said first imaging optical system, corresponding to an object point position of said second imaging optical system, to a re-imaging plane where the intermediate image is re-imaged.

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② 13. (Currently Amended) A projection optical system according to Claim 3 1, further comprising a field stop adjacent to an intermediate image to be formed by said first imaging optical system.

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③ 37. (Currently Amended) A projection optical system, comprising:  
at least ~~one lens~~ two lenses;  
at least one concave mirror;  
at least one diffractive optical element;  
a first imaging optical system having one of said at least ~~one lens~~ two lenses  
and said at least one concave mirror, for imaging an intermediate image of an object,

wherein said first imaging optical system includes at least a lens having a positive refractive power, a reflection mirror and said concave mirror, which are disposed in the order mentioned above, from the object side; and

28 a second imaging optical system having ~~said at least~~ another one lens of said at least two lenses and said at least one diffractive optical element, for projecting the intermediate image onto an image plane,

wherein said first and second imaging optical systems are disposed along a common straight optical axis, and wherein abaxial light from the object as reflected and collected by said concave mirror ~~is caused by said mirror to pass~~ passes through an outside portion of an effective diameter of said concave mirror, toward the image plane side.

38. (Currently Amended) A projection optical system according to Claim 37, wherein said at least two lenses, said at least one concave mirror and said at least one diffractive optical element have a positive refractive power, respectively, and wherein said projection optical system does not include a lens having a negative ~~refractive~~ power, a mirror having a negative ~~refractive~~ power, ~~a mirror having a negative refractive power~~ or a diffractive optical element having a negative refractive power.

39. (Currently Amended) A projection optical system according to Claim 37, wherein said at least ~~one lens~~ two lenses, said at least one concave mirror and said at least one diffractive optical element include a lens, a concave mirror and a diffractive optical element of a positive ~~refractive~~ power.

40. (Previously Added) A projection optical system according to Claim 37, further comprising a field optical system disposed between said first and second imaging optical systems.

41. (Previously Added) A projection optical system according to Claim 37, further comprising a lens group disposed between said reflection mirror and said concave mirror.

42. (Currently Amended) A projection optical system according to Claim 41, wherein said lens group has a negative refractive power and is disposed between said concave mirror and a lens, in said first imaging optical system, having a positive refractive power.

43. (Previously Added) A projection optical system according to Claim 37, further comprising a reflection surface disposed adjacent to an intermediate image formed by said first imaging optical system, and wherein abaxial light from the object as reflected and collected by said concave mirror is deflected by said reflection surface toward said second imaging optical system.

44. (Previously Amended) A projection optical system according to Claim 37, wherein at least one of said at least one diffractive optical element of said projection optical system satisfies a relation:

$$3 < MP/\lambda < 50$$

where MP is a minimum pitch (micron) of the diffractive optical element, and  $\lambda$  is the exposure wavelength (micron).

45. (Previously Amended) A projection optical system according to Claim 37, wherein at least one of said at least one diffractive optical element of said projection optical system satisfies a relation:

$$|L_d/L_{g2}| < 0.2$$

where  $L_d$  is the distance between an aperture stop of said second imaging optical system and said diffractive optical element, and  $L_{g2}$  is the distance from a paraxial image plane position of an intermediate image formed by said first imaging optical system, corresponding to an object point position of said second imaging optical system, to a re-imaging plane where the intermediate image is re-imaged.

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46. (Currently Amended) A projection optical system according to Claim 39 37, further comprising a field stop adjacent to an intermediate image to be formed by said first imaging optical system.

Claims 47 through 53 are cancelled.

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54. (Currently Amended) A device manufacturing method, comprising the steps of:

exposing a wafer to a device pattern using a projection optical element system according to Claim ~~48~~ 1; and



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developing the exposed wafer.

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Claim 55 is cancelled.

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D12

56. (New) A device manufacturing method, comprising the steps of:  
exposing a wafer to a device pattern using a projection optical element  
system according to Claim 2; and  
developing the exposed wafer.

57. (New) A device manufacturing method, comprising the steps of:  
exposing a wafer to a device pattern using a projection optical element  
system according to Claim 10; and  
developing the exposed wafer.

58. (New) A device manufacturing method, comprising the steps of:  
exposing a wafer to a device pattern using a projection optical element  
system according to Claim 12; and  
developing the exposed wafer.

59. (New) A device manufacturing method, comprising the steps of:  
exposing a wafer to a device pattern using a projection optical element  
system according to Claim 37; and  
developing the exposed wafer.

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